Module 3.

Erosion and Sediment Control Practices

Module 3

Introduction

Technical Assistance

- Section 62.1-44.15:52. B. of the VESCL requires the Department to provide technical assistance and advice to, and conduct and supervise educational programs for VESCP authorities.
- One way the Department accomplishes this is with the Virginia Erosion and Sediment Control Handbook

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Virginia Erosion and Sediment Control Handbook (Table 3-1)

Chapter 1	Introduction
Chapter 2	Erosion and Sediment Control Principles, Practices and Cost
Appendix	Wall Chart (Unified Coding System)
Chapter 3	State Minimum Standards and Specifications
Chapter 4	Stormwater Runoff
Chapter 5	Engineering Calculations
Chapter 6 Appendices	Preparing an Erosion and Sediment Control Plan 6-A: Soils Information 6-B: Soil Survey Information 6-C: List of Soil Types
Chapter 7 Appendices	Administrative Guidelines 7-A: Sample Administrative Forms 7-B: Enforcement Flow Chart 7-C: Directory
Chapter 8	Virginia Erosion and Sediment Control Law and Regulations
Appendix	Glossary

Technical Assistance

- Safety (3.01)
- Road Stabilization (3.02, 3.03)
- Sediment Barriers (3.04, 3.05, 3.06, 3.07, 3.08)
- Dikes and Diversions (3.09, 3.10, 3.11, 3.12)
- Sediment Traps and Basins (3.13, 3.14)
- Flumes (3.15, 3.16)
- Waterway and Outlet Protection (3.17, 3.18, 3.19, 3.20, 3.21)
- Stream Protection (3.22, 3.23, 3.24, 3.25, 3.26, 3.27)
- Subsurface Drainage (3.28)
- Site Preparation for Vegetative Establishment (3.29, 3.30)
- Grass Establishment (3.31, 3.32, 3.33, 3.34)
- Mulches (3.35, 3.36)
- Other Vegetative Controls (3.37, 3.38)
- Dust Controls (3.39)

Organization of ESCH Specifications

- **Definition**
- **Purpose**
- **Condition Where Practice Applies**
- **Planning Considerations**
- **Design Criteria**
- **Construction Specifications**
- **Maintenance**

Module 3

The Erosion and Sediment Control Specifications (for inspectors)

Turn to Chapter 3 in your handbook

3.01 (SAF) – Safety Fence (p. III-1)

Safety fence is not a ESC Practice; but is a protective barrier used for:

- Delineation of project or property boundary
- Limiting access/Public safety/Traps, Basins
- Delineation of areas not to be disturbed or protected (i.e., for tree protection or areas used in the future for stormwater infiltration practices)

MODULE 3 | ESC SPECIFICATIONS

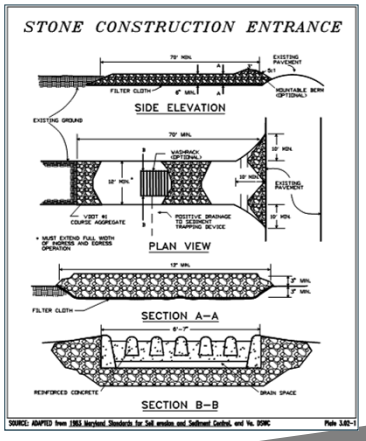
3.01 (SAF) – Safety Fence (p. III-2)

- Plastic fence min. height is 5 feet
- Metal fence min. height is 6 feet

Maintenance – repair and or replace as needed

3.02 (CE) – Construction Entrance (p. III-6)

- Prevents tracking of mud
- MS 4 &17 (Minimize tracking of mud/dirt into paved public roads)



Design/Construction Specifications (p. III-7)

- 6" thick - 12' wide & 70' long
- Excavated 3"
- VDOT #1 aggregate (2-3" stone)
- Filter cloth under
- Wash water must be carried to an approved settling area (wash rack)

Maintenance per MS17

- Mud shall be removed from paved areas at the end of the day.
- Cleaning of pavement shall be done by shoveling and sweeping
- Wash pavement ONLY after shoveling and sweeping

Construction entrance problems

3.03 (CRS) – Construction Road Stabilization (p. III-11)

Design/Construction Specifications (p. III-12); MS 1

Installed per approved plan (14' = 1 way; 20' = 2 way)

- **Correct stone size (VDOT #1)**
- **Inspect for sediment accumulation on stone**

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3.04 (STB)– Straw Bale Barrier (p. III-14)

Design/Construction Specifications (p.III-15)

- MS-4
- Life span = less than 3 months
- Can only be used for sheet flow conditions (total drainage area ¼ acre per 100 feet)
- Installed on contour (no end runs)
- 2 Stakes per bale
- Entrenched and backfilled
- Cleanout sediment (½ the barrier height) p.17

Straw Bale Problems

3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-20-21)

- MS 4
- Should only be used for sheet flow conditions (total drainage area ¼ acre per 100 feet)
- However, if constructed across a ditch concentrated flow should be <1 cfs
- Should be installed on contour (no end runs)

3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-20-21)

- To be placed 5-7 feet beyond the base of a slope > 7%
- Height above ground
  - Min=16”
  - Max= 34”

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3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-21-22)

- Stakes:
  - 5’ length
  - Oak – 2” dia. – max 6’ apart
  - Pine – 4” dia. – max 6’ apart
  - Steel – weight of 1.33 pounds per foot

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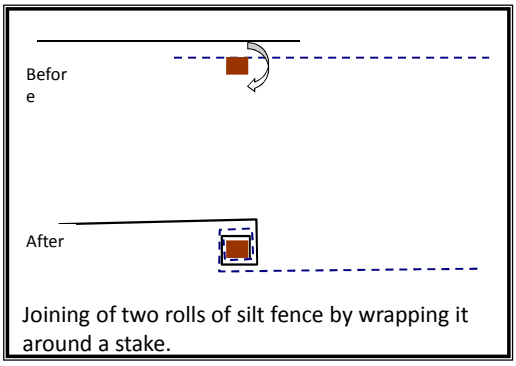
In joints that overlap, min. of 6” of fabric around the stake (p. III-23)



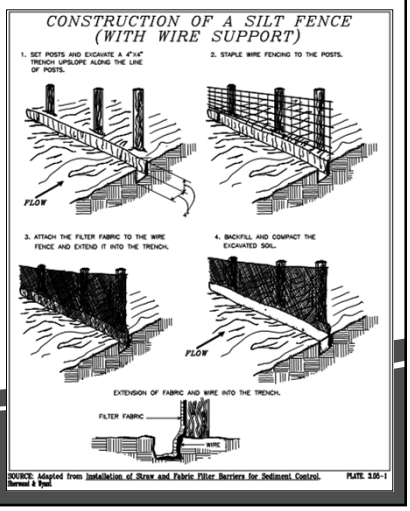
Joining of two rolls of silt fence by wrapping it around a stake.

Joining two sections of silt fence

3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-23)

- 4" deep and 4" wide trench on upslope side ➔ 8" of fabric in ditch
- Post shall be properly spaced
- Backfill trench and compact
- Fabric not to be stapled to trees



3.05 (SF) – Silt Fence (p. III-26)

Maintenance

- Inspect after rainfall events
- Repair areas of end runs or undercutting
- Life span ~ 6 months
- Cleanout (½ barrier height)
- Remove when no longer needed (MS18)

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Silt Fence Problems

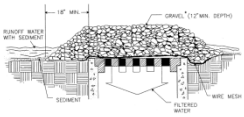
3.07 (IP) – Storm Drain Inlet Protection (P. III-31)

MS-10

Types of drop inlet structures:

1. Silt fence
2. Gravel and wire
3. Block and gravel
4. Others*

GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER



Storm Drain Inlet Protection MS-10

Design/Construction Specifications (p. III-33)

- Max. Drainage Area = 1 Acre
- Shall not create excessive ponding
- Filter fabric can be added

Storm Drain Inlet Protection MS-10

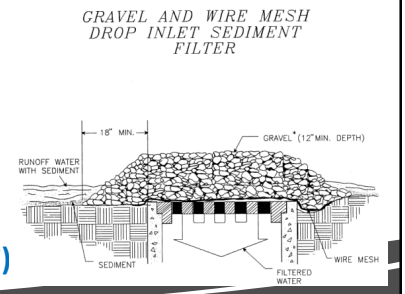
Design/Construction Specifications (p. III-33-34)

- Silt Fence Drop inlet IP
- Use 2 X 4 stakes for vertical and horizontal
- Space 2 X 4's 3 feet apart
- Entrench fabric 12 inches around inlet (see detail p. III-35)

Storm Drain Inlet Protection MS-10

Design/Construction Specifications (p. III-34)

- Gravel & Wire Mesh Drop inlet IP
- Use ½" wire mesh over inlet
- Place stone over the wire
- Depth of stone shall be at least 12 inches
- Can also be used for curb inlets (p. 37)



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Storm Drain Inlet Protection MS-10

Design/Construction Specifications (p. III-34)

- Block & Gravel Drop inlet IP
- Use 4", 8" or 12" concrete block
- Shall be at least 12" high
- Use ½" wire mesh

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3.07 (IP) – Storm Drain Inlet Protection (P. III-42) MS-10

Wooden weir & Block and gravel curb inlet protection

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Inlet Protection Problems

More Inlet Protection Problems

Other Inlet Protection Devices

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3.08 (CIP) – Culvert Inlet Protection (p. III-46) MS-10

Silt fence culvert inlet protection

- Must be constructed in a manner to facilitated clean out
- Provides protection from disturbed area above the culvert
- Types include:
  - Silt Fence
  - Sediment Trap

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3.08 (CIP) – Culvert Inlet Protection (p. III-47-48) MS-10

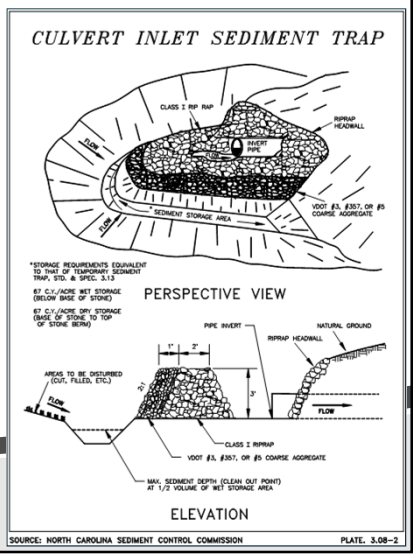
Silt fence culvert inlet protection

- Expected useful life span is 3 months
- No more than 1 acre of drainage
- Minimum of 16” high
- Maximum of 34 inches

3.08 (CIP) – Culvert Inlet Protection (p. III-48) MS-10

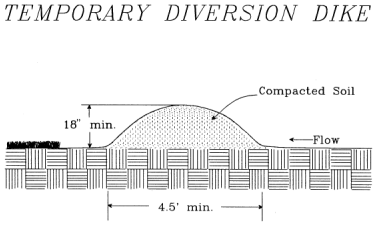
Culvert Inlet sediment trap

- Constructed per approved plan and specifications
- Toe of riprap no closer than 24" from opening
- Proper cleanout/maintenance



3.09 (DD) – Temporary Diversion Dike (p. III-52)

- Temporary measure, usually to be installed as a first step measure (MS-4) and to be stabilized immediately (MS-5)
- Must have a positive grade, stable outfall or outlet



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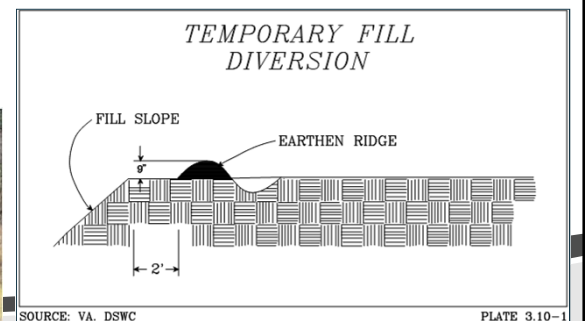
Problem temporary diversion dikes

3.10 (FD) – Temporary Fill Diversion (p. III-56) MS-7 & 8

- Temporary structural measure, usually installed at the end of a working day on an active fill slope
- Needs positive grade to stable outfall
- Does NOT require stabilization = Maximum life 1 week
- Min. height = 9 inches



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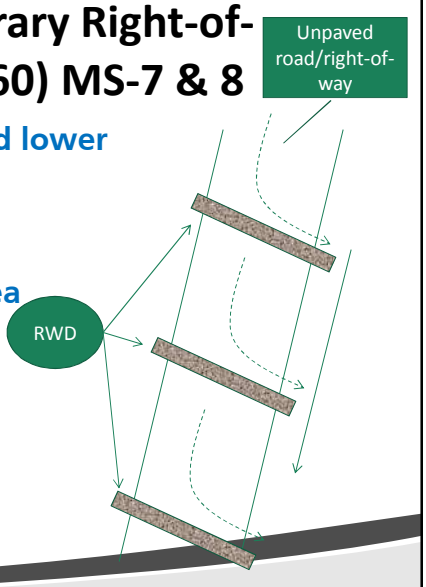
Incorrect construction of a Temporary Fill Diversion

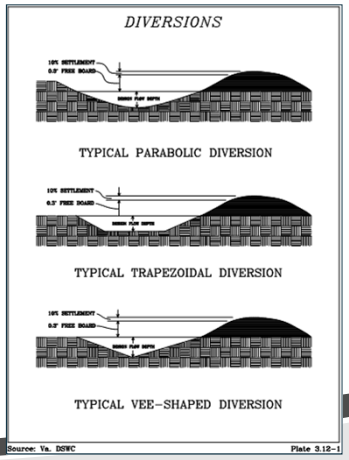
3.11 (RWD) – Temporary Right-of-Way Diversion (p. III-60) MS-7 & 8

- Used to shorten slope length and lower velocity of runoff
- Min. height 18 inches
- Needs proper spacing (p.63)
- Needs to outfall to stabilized area
- Mountable by vehicles



3.12 (DV) – Diversions (p. III-65) MS-7 & 8

- Diversions are permanent and installed for a very specific reason
- Associated with a channel on the upslope side
- Need to be stabilized immediately after construction before making active (MS-5)
- Requires outlet protection



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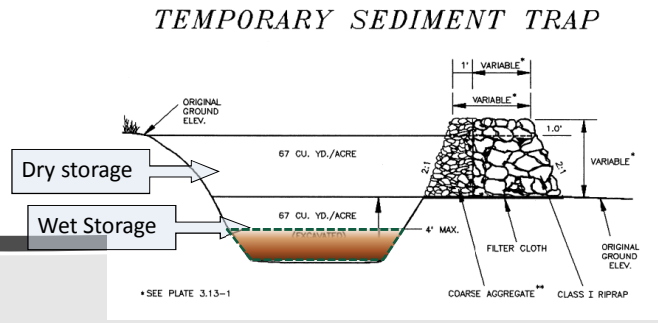
Diversion examples

3.13 (ST) – Temporary Sediment Trap (p. III-70)

MS-6 (a)

- **Must have a storage capacity of 134 cubic yards per acre of drainage area**
- **Storage volume = 50% dry; 50% wet**
- **Drainage areas less than 3 acres**



Sediment Trap Inspection Considerations

- **Design/Construction Specifications (p. III-73)**
- **Side slopes no greater than 1:1 and maximum depth of wet storage is 4 feet**
- **Stone outlet:**
  - **Two sizes of stone-smaller size to provide filtering and the larger (rip-rap) to provide outlet stability**
  - **Filter cloth installed under the rock outlet**
  - **Outlet must be one foot lower than embankment**

Sediment Trap Inspection Considerations

- Design/Construction Specifications (p. III-73-74)

- Embankment is constructed in 6” lifts using clean soil that has no roots, rock or other objectionable material
- MS-5 Requires seeding immediately after construction
- Maximum embankment height is 5 feet

Sediment Trap Inspection Considerations

- Maintenance (p. III-75)

- Must be cleaned out when sediment reaches half of the wet storage volume
- Inspect at least once every two weeks and repair any damage immediately; and
- Make sure outlet rock is not clogged

Sediment Trap Examples

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Sediment Trap Inspection Problems

3.14 (SB) - Temporary Sediment Basin (p. III-77)

MS-6 (b)

- Required for drainage areas ≥ 3 acres
- Shall have a capacity of 134 cubic yards per acre of drainage

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3.14 (SB) - Temporary Sediment Basin (p. III-77)

- Max. drainage area = 100 acres; min. = 3 acres;
- Outlets must pass 10 yr storm volume
- Must maintain permanent pool of water (67 cubic yds./ acre)

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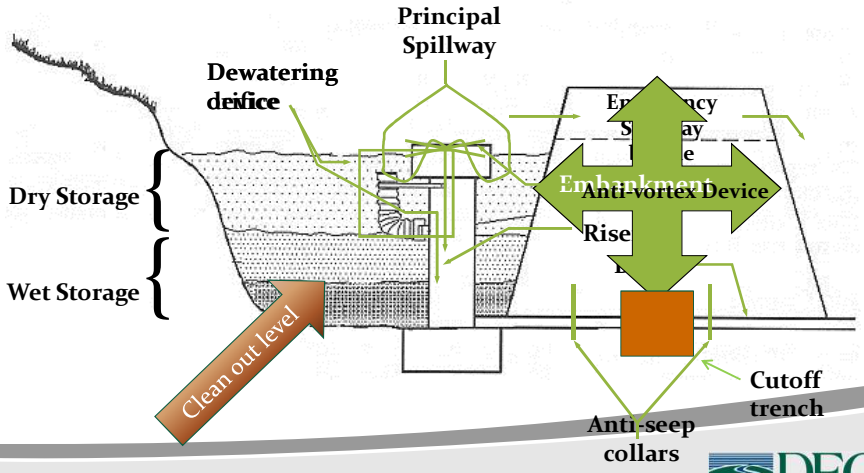
3.14 (SB) - Temporary Sediment Basin



Sediment Basin Construction Specifications (p. III-88-89)

- Embankment
  - Cross sections (width height, slope) must be in accordance with the approved plan
  - Fill material shall be approved and shall achieve a compaction of 95%
  - Must be placed and compacted in 6 inch layers or lifts

Sediment Basin Construction Specifications (p. III-88-89)

- Principle Spillway
  - Fill material shall be placed in 4 inch layers or lifts and compacted carefully
  - A minimum of 2 feet of material needs to be over the barrel before equipment can traverse
  - The minimum diameter is 15 inches and shall be a minimum of 1 foot below the crest of the emergency spillway

Sediment Basin Construction Design/Construction Specifications (p. III-81-82)

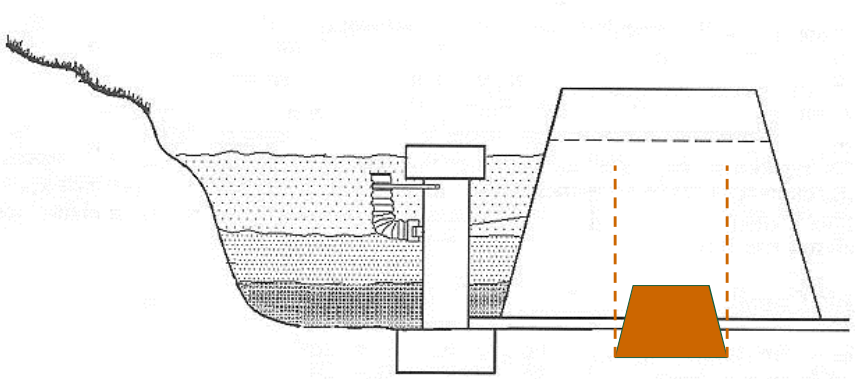
- Anti-vortex device and trash rack shall be attached to the top of the principle spillway
- De-watering device shall be attached to riser
- The base of the riser shall be anchored by either concrete or steel plate (see approved plan for details)
- The barrel shall have a watertight connection to the riser and shall have outlet protection

Sediment Basin Construction Design/Construction Specifications (p. III-84)

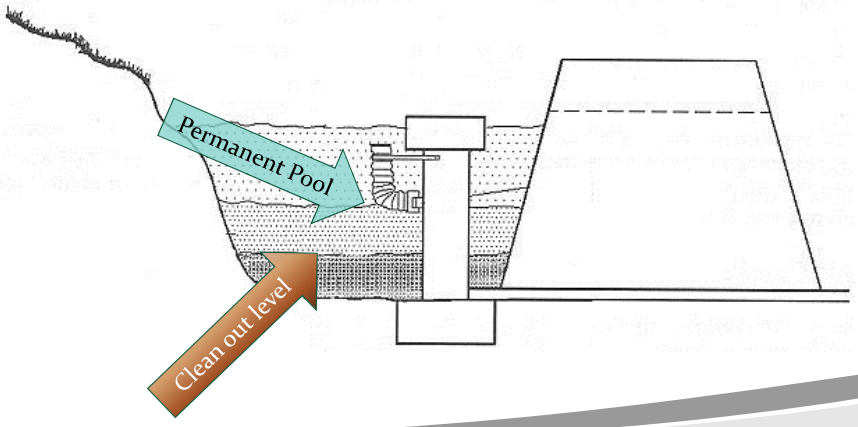
- Anti-seep collars to control seepage may or may not be required. See approved plan
- If so, compaction around these are critical (95%)
- The embankment and sides of the basin shall be stabilized immediately per MS 5

Sediment Basin Construction Specifications (p. III-88)

- The cutoff trench must be installed properly



Sediment Basin Maintenance (p. III-90)



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Sediment Basin Examples

3.15 (TSD) – Temporary Slope Drain (p. III-116)

- Used in conjunction with a diversion dike
- MS-8

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Temporary Slope Drain Design/Construction Specifications (p. III-117-118)

- Maximum Drainage area is 5 acres
- Need to be sized according to table 3.15-A
- Inlet shall be a standard flared end section and have inlet protection
- Entrance of the drain is located at a low point
- The dike at the inlet of the drain must be properly compacted

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Temporary Slope Drain Design/Construction Specifications (p. III-118-119)

- Entrance of the drain has a slope of ½ inch per foot
- Make sure slope drain has been properly anchored down the slope with water tight fittings
- Make sure proper outlet protection is installed

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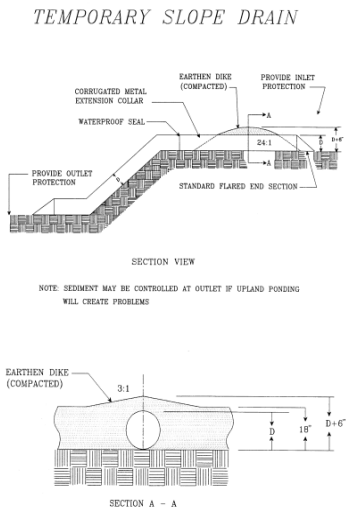
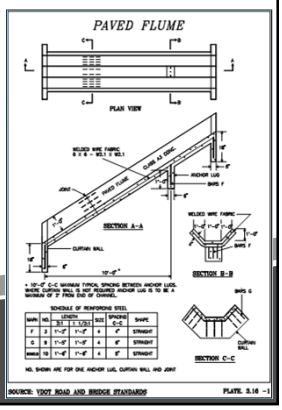
Incorrect Temporary Slope Drain examples



3.16 (PF) – Paved Flume (p. III-123)

Is a permanent paved/concrete channel constructed on a slope MS-8, 10 or 11

- **Cross section (p.-125)**
  - **Maximum slope ratio is 1.5:1**
  - **Must have curtain walls top and bottom**
  - **See detail p. 127**
  - **Must have anchor lugs per specification**



3.16 (PF) – Paved Flume (p. III-123)

- **Cross section (p.-125)**

- **Expansion joints are required every 90 feet**
- **Outlet protection & energy dissipater**
- **Must handle 10 yr. peak storm**

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3.17 (SCC) – Stormwater Conveyance Channels (p. III-130) MS-5, 19

Three different types:

Grass, Rip-Rap, Concrete

Three different shapes:

V-Shape, Parabolic and Trapezoidal

Stormwater Conveyance Channel Inspection Items

- **In rip rap or concrete lined channels, the finished cross-section and elevation of the stone or concrete is ≤ elevation of the diversion or tributary @ the point of intersection.**

Stormwater Conveyance Channel Inspection Items

- For rip rap channels, was filter cloth installed underneath?
- For concrete channels were expansion joints installed every 100 feet?

Stormwater Conveyance Channel Inspection Items

- Grass lined channels must be stabilized before made operational
- All channels need: outlet protection and to discharge into an adequate channel

MODULE 3 | ESC SPECIFICATIONS

Stormwater Conveyance Channel Inspection Items

- Erosion in a grass lined channel may occur because of excessive velocity
- Channels should be inspected frequently for erosion & under scour
- See table on page III-135

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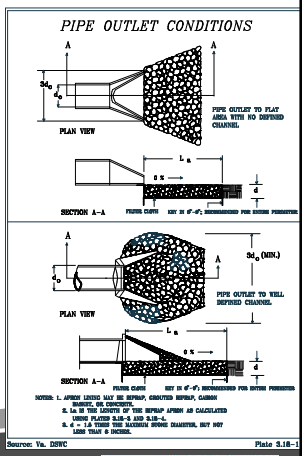
Examples of Stormwater Conveyance Channels

3.18 (OP) – Outlet Protection (p. III-154)

Used to dissipate energy of runoff discharged from channels, pipes, conveyances (MS-11) and prevent erosion in the receiving channel.

3.18 (OP) – Outlet Protection (p. III-155)

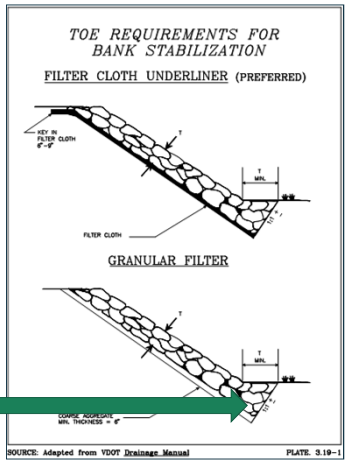
- Installed at 0% grade
- First excavate to depth shown on the approved plan or details
- Install filter fabric
- Place rock to correct depth, length and width
- Smooth transition with natural channel
- If in a well defined channel, side slope no greater than 2:1



Maybe?

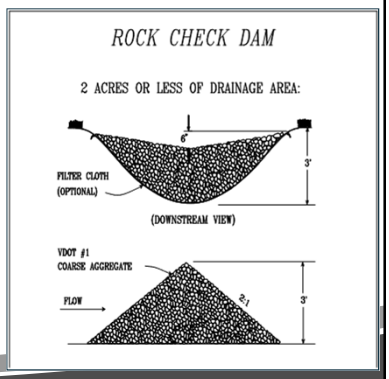
3.19 (RR) – Riprap (p. III-166) MS-7, 11 & 19

- Make sure there is a filter fabric underlayment
- Check the stone size to make sure it is correct
- Should be laid to full thickness in one operation
- Make sure the toe was installed



3.20 (CD) – Rock Check Dams (p. III-185)

- Verify correct stone size was used
- Two stone sizes depending on drainage area
- Verify stone was laid correctly and center of the dam is 6 inches lower than edges



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3.20 (CD) – Rock Check Dams (p. III-185) Design/Construction Specifications (p. III-186-188)

- Used to reduce velocity in a ditch or swale
- Max. height is 3 feet.
- Remove accumulated sediment when it exceeds half the height of the dam

3.23 (SSS) – Structural Streambank Stabilization (p. III-210) MS-15

- Often part of a stream restoration project or erosion abatement
- Can be done with rip rap, gabions or other non-erodible materials
- Limit the disturbed area while stabilization excavation is being performed
- What other MS would apply?

3.24 (SC) – Temporary Vehicular Stream Crossing (p. III-218-219) MS-13

- Temporary crossings should be constructed of non-erodible materials
- The type will depend on drainage area
- Bridges must be anchored

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3.24 (SC) – Temporary Vehicular Stream Crossing (p. III-219) MS-13

- Make sure sediment trapping measures have been installed along the access road leading to the stream crossing (div. dikes, silt fence, const road stabilization)

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3.24 (SC) – Temporary Vehicular Stream Crossing (p. III-219) MS-13

- Culvert crossing p.221
- Filter cloth placed on bed & back before pipe placement
- Proper stone size and stabilization over the pipes are critical

3.25 (USC) – Utility Stream Crossing (p. III-227-237) MS-12, 13, 14

- Type A, B, or C (velocity dependent)
- Must be operational and stabile before construction activity begins
- Inspect at the end of each day for construction material stability
- See page 230 for example

3.26 (DS) – Dewatering Structure (p. III-238) MS-16 (C)

- The type used must sized correctly and not overfilled
- Storage capacity ($ft.^3$) should = 16 x pump discharge capacity (GPM)

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3.26 (DS) – Dewatering Structure (p. III-238) MS-16 (C)

- Ensure proper settlement of the structure is adhered to before cleaning out the sediment (p. 243)
- Clean-out at 1/3 the capacity

3.27 (TC) – Turbidity Curtain (p. III-246) MS-12, 14

- Used to provide sediment protection when working along the edge in water
- See page 254 for installation methods

3.28 (SD) – Subsurface Drain (p. III-256), MS 9

- Used in areas of high water tables and on water seeps on a slope face
- There are several ways and materials choices to use

3.29 (SR) – Surface Roughening (p. III-273); MS 1

Purpose: To slow down water and increase infiltration down; thus, reducing erosion

- **Make sure groves, cleat tracks or other roughing are oriented horizontally (not vertically)**

Slope roughening examples

Area should be seeded & mulched per MS?

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Vegetative Erosion Controls

3.30 (TS) – Topsoiling (p. III-279)

Topsoiling consists of 3 processes:

1. Stripping

2. Stockpiling

3. Spreading

MS 2 – stockpiling

MS 3 – Permanent seeding

Topsoil

- Original soil
- Soil (micro)organisms
- Good growing medium
- Nutrients
- High water holding capacity
- Low bulk density
- Organic matter

Topsoil

- Stock piling (takes up space)
- Requires more time to strip, stock pile and reapply
- Increased exposure time of denuded areas
- Weed seeds

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Topsoil Stripping and Stockpiling Specifications (p. III-281-282)

- Make sure perimeter controls are in place prior to stripping
- Avoiding stripping of soil when it is frozen or wet
- Limit areas to be stripped to those designated for construction

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Topsoil Stripping and Stockpiling

- Stockpiles must be stabilized in accordance with MS2
- Stockpiles off-site must be inspected as well

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Topsoil Stockpiles

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Topsoil Spreading (p. 282)

- Ensure subsoil is loosened to provide a good bond between the subsoil and the topsoil
- Verify topsoil is spread to a minimum depth of 2" on 3:1 or steeper slopes and 4" on flatter slopes

- Ensure good contact between the subsoil and topsoil
- Note table 3.30-A for quantity

3.(31) TS – Temporary Seeding (p. III-284)

Used for:

- Compliance with MS-1
- Compliance with MS-5
- As a nurse crop to bridge to an optimal time for permanent seeding

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Temporary Seeding

- Determine if denuded areas will remain dormant for longer than 14 days (MS-1)
- Make sure the area is mulched after seeding
- Make sure the seed used is appropriate for the time of year (see table 3.31-B p. 287 & 3.31-C p. 288)

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Permanent Seeding (3.32)

Used for:
- Compliance with MS-1 and MS-3

Need:
- Good growing medium/soil
- Good plant material

Soil and Plant Material Requirements

- Verify the soil is at least 12 inches deep (to bedrock or impermeable layer)
- Check the approved plan for appropriate type of plants for your area
- Check to see if the soil has been tested by a soils laboratory and recommendations for the soil pH and nutrient content have been made

Soil and Plant Material Requirements

- Make sure the soil does not contain large amounts of rocks, woody materials, or construction debris
- Only, certified seed should be used

Soil and Plant Material Requirements

- See pages 296-301 for plant information and uses
- Pages 302-305 provide recommendations for seed mixture

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Final inspection for Permanent Seeding

Is the area mulched after seeding? (3.35)



Is permanent stabilization achieved? (MS-3)



3.33 (SO) – Sodding (p. III-332)

Positive	Negative
• Immediate results/erosion, dust, mud control • Can be established almost year-round • No weeds • Area can be used quickly after sodding • Less prone to failure	• Limited species selection and diversity • Expensive • Difficult to sod inaccessible places • Warm soil in summer may reduce establishment of cool season grasses • Watering requirements for establishment

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Inspecting Sodding Operations

- Site Preparation
- Installation
- Maintenance

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Sod Installation Considerations

- Soil was slightly irrigated if sodding occurs during very dry weather
- Sod is installed within 36 hours of harvesting
- Sod is unrolled to provide soil contact

Installation of Sod (p.336)

- Sod is laid in staggered rows
- Sod is tightly butted against each other
- Sod installed on steep slopes is anchored

Installation in Waterways (p. 340)

- Sod strips in waterways should be laid perpendicular to the flow
- Butt ends tightly
- Peg or staple after rolling

3.34 (BE)/(ZE) – Bermuda and Zoysia grass (p. III-343) MS-3

- Plant specimens should be planted between May 1 and July 15 (full coverage in 8 to 12 weeks)
- Suited for sunny locations (both grass species are intolerant to shade)

3.35 (MU) – Mulching (p. III-349)

- Protect the soil from raindrop impacts, thus reducing erosion
- Provide a favorable microclimate for seed germination and plant establishment

#1 choice of mulch is straw – applied at 2 tons/acre
Fiber mulch – applied at 500-750 lbs/acre over straw mulch
Other organic mulches: Table 3.35-A


MODULE 3 | ESC SPECIFICATIONS

3.36 (B/M) – Blankets & Matting (p. III-356)

- Treatment 1 (VDOT EC-2) is a (bio) degradable blanket

- Treatment 2 mats (VDOT EC-3) are non-degradable plastic structures

Installation

Stabilization Blanket/Matting Inspections

- Need to be installed according to the approved plan, specifications in the VESCH and/or manufacturer recommendations
- Installation on a relatively smooth soil with no clods, rock, or rills
- Ensure there is proper contact between the mat and the soil by laying them loosely on the soil (note: stretching the blankets and mats will lift the materials and reduce soil contact)

Stabilization Blanket/Matting Inspections

- Confirm if check slots are required and if so verify if they are installed properly
- Confirm proper orientation (overlap)in accordance with the VESCH
- Ensure manufacturer's specifications on stapling or staking are followed
- Inspect for undermining and undercutting until permanently vegetated and stabilized

MODULE 3 | ESC SPECIFICATIONS

3.37 (VEG) – Trees, Shrubs, Vines & Ground Covers (p. III-369)

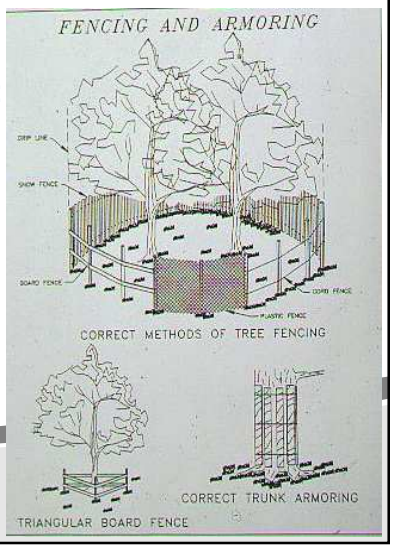
Inspection items for establishing tree or woody vegetation include:

- **Ensure that good, vigorous plant material is being used**
- **Ensure the plants are properly planted, watered, and mulched**

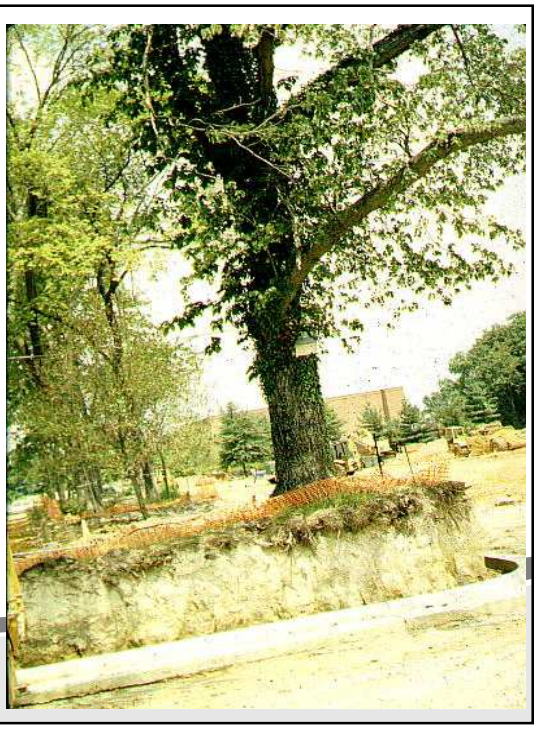
3.38 (TP) – Tree Preservation & Protection (p. III-393)

Inspection items for tree preservation and protection include:

- **Make sure protection is installed at the drip line to minimize root damage from equipment**
- **Check the tree protection area for potential infringements (such as vehicle parking, storage and other damage)**
- **Make sure the fencing and armoring is not damaged**



Tree Protection and Preservation



3.39 (DC) – Dust Control (p. III-414)

Dust Control Measures:

- ***Vegetative cover*** **- areas of no construction traffic**
- ***Mulch*** **- Fast & effective; not in traffic areas - use binders to tack**
- ***Tillage*** **- Emergency measure to bring clods to surface**
- ***Irrigation*** **- Keep surface wet**
- ***Spray on adhesives*** **- Organics - derivatives of pine tar and vegetable gum**

End of Module 3